

Air Pollution Emissions from Platform Decommissioning

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Rigs to Reefs?
Options for Platform Decommissioning



On the Agenda...

- Decommissioning → diesel engines → air pollution
- Cantle's Rule of Additive Pollution: depth, amount
- Platform Harmony example case (full vs. partial)
- Regulatory & technical advances, pmt negotiations
- Summary



Decommissioning and Diesel

- Decommissioning means diesel engines... lots and lots of diesel engines... which means air pollution
 - Criteria pollutants (NO_x , SO_x , O_3 , CO , PM_{10} , $\text{PM}_{2.5}$)
 - HAPs & TACs (diesel PM is a highly toxic stew)
 - Greenhouse gases, aerosols (CO_2 , CH_4 , N_2O , Fl comp'ds)
- Ubiquity – engines are used throughout process
 - Onshore: salvage/recycling, port facilities, transportation
 - Offshore: vessels, barges, cranes, pumps, compressors
 - Variables: size (20-3000+ hp), age, em facs & fuel use



Decommissioning Emissions (cont.)

- Cantle's Rule of Additive Pollution: emissions ↑ with...
 - Depth (platform size, weight; weather & sea state)
 - Amount to be removed; some or all makes a difference!
- The deeper a platform is and the more that is to be removed, the greater the air pollution emissions
- Relates to “time on station” of the equipment array
 - Platform Harmony example



Platform Harmony Case Study

- California's largest, deepest (70,000 tons, 1200 ft)
- Two cases considered...
 - Full Removal (-15 ft below mud line, as required)
 - Partial Removal (topsides & jacket to -85 ft msl)
- Considers only *topsides + jacket removal* phase
- All materials brought to shore (recycling, disposal)
- Heavy Lift Vessel & support vessels on station
 - HLV DB 50 (30K+ hp), offshore tugs, barges, other



Harmony, cont.



- Installed 1989, 6.4 mi S of Gaviota, Sa Barbara County
- 1200 ft water depth
- 70,000 ton structure
- Produces into the Las Flores Canyon facility
- Oil transported out of County by pipeline



Harmony, cont.



- Heavy Lift Vessel
- DB 50 (McDermott)
- >30,000 hp
 - five 3600 hp gen sets
 - four 3200 hp DP engines
- 230+ crew
- Cranes, compressors, welding, boilers, etc.



Harmony, cont.



- Offshore Tugs
 - Ocean-going (124 ft)
 - High hp (6,100)
 - 9 kt cruising w/ tow



Harmony, cont.



- Anchor Handling & Support Vessel
 - 12,000 hp (mains)
 - 4,000 hp aux gens, other
 - 220 ft length



Harmony Emissions Comparison

Partial Removal

NO _x	89 tons
ROC	3 tons
CO	7 tons
CO ₂	4,400 tons
PM	3 tons

Full Removal

NO _x	600 tons
ROC	22 tons
CO	50 tons
CO ₂	29,400 tons
PM	21 tons



Harmony Emissions Observations

- Obvious: Time on Station drives emissions
- Time on Station increases with depth and amount of platform to be removed
 - 6 - 7X multiplier (full vs. partial removal)
- Subtle: Removal decision may affect equip't choice
 - Smaller HLV possible with less removal
 - Possible less support equip't, barging as well



Regulatory & Technical Setting

- Recent regulatory changes will reduce emissions
 - CA diesel (15 ppmw S) to be used in decommissioning
 - Allows particulate filters, oxidation catalysts, other technologies previously precluded (and not analyzed)
 - Big reductions to PM, CO, ROC, NO_x of either option
- Permit negotiations with districts
 - Not considered in case study
 - Engineering analysis looks at all equip't
 - Effective in driving down project's emission profile
 - Chevron 4H Project (120 tons NO_x vs 22 NO_x)



Summary

Air Pollution from Platform Decommissioning

- Decommissioning means diesel engines
 - Huge array of different sizes, characteristics
 - Highly reliable but big polluters (diesel exhaust **bad!**)
- Emissions increase with depth, amount
 - Cantle's Rule of Additive Pollution and time on station.
- Platform Harmony Example
 - 6-7X multiplier comparing full vs partial removal
- Reg & tech changes and permit negotiations will drive decommissioning emission profiles down



Questions?
Discussion?

